Chemistry and Analysis by Alpha Spectrometry of D-38 in Legacy Waste Samples

Lennox J. Harris, Jay A. Dixon, Bryan B. Bandong, Everett B. Guthrie, Howard Hall, and Anthony Be Lue

Isotopes Sciences Division, Chemistry and Environmental Sciences Division, of the Chemistry and Material Sciences Directorate, and the Enviornmental Protection Division Lawrence Livermore National Lab., CA (USA)

This paper reports on the chemistry techniques and subsequent analysis by alpha spectrometry of depleted uranium (DU or D-38) in legacy waste. Changing regulations by the regulatory bodies required recharacterization studies be performed on waste destined for waste repositories. Each waste disposal site now have specific needs (i.e. formulation, particle size, etc.) which determines the disposal method. In compliance with the new regulations Lawrence Livermore National Laboratory developed the Site Treatment Plan (STE), which dictates the mechanisms for disposal of specific kinds of waste (mixed waste, rad, etc.). The process starts with the identification of the content of a container by sample analysis, stabilization, reanalysis, and data validation.

The Chemical process includes weighing of a representative sample and digestion in hot concentrated nitric acid. Following the digestion and filtration the solution in low molar concentration nitric acid is prepared for addition to the ion exchange column with the appropriate tracers and carriers. The ion exchange columns prepared used the TRU and UTEVA resins (EiChrome Industries) separately. These resins were developed to selectively remove thorium, uranium, plutonium, and americium (TUPA) from solution.

Characterization studies of several waste drums containing uranium present as uranium metal turnings, uranium oxides, silicon-bearing metallic uranium and uranium silicates were sampled, identified, and analyzed. The waste drums were found to contain D-38 with activities ranging from 9×10^{-8} to 2.5×10^{-4} uCi/g. In addition plutonium and americium were detected from the 10^{-7} to 10^{-5} uCi/g levels by alpha spectrometry. Although not an unusual find at these levels represent a challenge for the disposal of the waste. As a result of this study, several alternatives for the separation, treatment, and disposal procedures of legacy waste are identified that would result in meeting the regulatory levels in micron size, and standard activity (pCi/g of soil) as defined by the Nuclear Regulatory Commission for disposal of waste at disposal Sites.

References:

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